Claims

1. A heat exchanger (1) for cooling three cooling bodies, the heat exchanger (1) comprising:

a first heat exchanger (9) comprising a first heat radiating area (23) arranged to receive a flow of a first cooling body and to radiate heat therefrom; and

a second heat exchanger (11) comprising a second heat radiating area (25) arranged to receive a flow of a second cooling body and to radiate heat therefrom and a third heat radiating area (27) arranged to receive a flow of a third cooling body and to radiate heat therefrom; wherein

the second and third cooling bodies are disposed parallel to the respective second and third heat radiating areas (25,27), and the second and third heat radiating areas (25,27) are disposed rearward of the first heat radiating area (23), and

wherein, in use, the difference in temperature between the first cooling body entering the first heat radiating area (23) and exiting the first heat radiating area (23) is greater than the difference in temperature between the second cooling body entering the second heat radiating area (25) and exiting the second heat radiating area (25) and greater than the difference in temperature between the third cooling body entering the third heat radiating area (27) and exiting the third heat radiating area (27), and the temperature of the second cooling body flowing through the second heat radiating area (25) is higher than the temperature of the third cooling body flowing through the third heat radiating area (27), and wherein

the second heat radiating area (25) is disposed on the upstream side of the flow direction of the first cooling body in the first heat radiating area (23), and the third heat radiating area (27) is located on the downstream side of the flow direction of the first cooling body in the first heat radiating area (23).

2. A heat exchanger (1) for cooling three cooling bodies, the heat exchanger (1) comprising:

a first heat exchanger (9) comprising a first heat radiating area (23) arranged to receive a flow of a first cooling body and to radiate heat therefrom; and

a second heat exchanger (11) comprising a second heat radiating area (25) arranged to receive a flow of a second cooling body and to radiate heat therefrom and a third heat radiating area (27) arranged to receive a flow of a third cooling body and to radiate heat therefrom;

wherein the second and third cooling bodies are disposed parallel to the respective second and third heat radiating areas (25,27), and the second and third heat radiating areas (25,27) are disposed rearward of the first heat radiating area (23), and wherein, in use,

the temperature of the first cooling body flowing through the first heat radiating area (23) is higher than the temperature of the second cooling body flowing through the second heat radiating area (25), and the temperature of the second cooling body flowing through the second heat radiating area (25) is higher than the temperature of the third cooling body flowing through the third heat radiating area (27), and wherein

the second heat radiating area (25) is disposed on the upstream side of the flow direction of the first cooling body in the first heat radiating area (23), and the third heat radiating area (27) is located on the downstream side of the flow direction of the first cooling body in the first heat radiating area (23).

3. A heat exchanger (1) according to Claim 1 or Claim 2, wherein the area of the first heat radiating area (23) disposed on a first face (2) of the first heat exchanger (9) is substantially the same as the combined areas of the second and third heat radiating areas (25,27) disposed on a first face (4) of the second heat exchanger (11), the first faces (2,4) being arranged to receive an airflow (A), in use.

4. A heat exchanger (1) according to any preceding claim, wherein the first heat

exchanger (9) is disposed substantially parallel to the second heat exchanger (11).

5. A heat exchanger (1) according to any preceding claim, wherein the second and third heat radiating areas (25,27) are disposed adjacent one another.

6. A heat exchanger (1) according to any preceding claim, wherein the second heat radiating area (25) is disposed between a first third heat radiating area portion (27a) and a second third heat radiating area portion (27b).

7. A heat exchanger (1) according to any preceding claim, for use in a vehicle having an air conditioning unit (7), a fuel cell (3) and a drive motor (5), wherein the first cooling body is arranged to transfer heat from the air conditioning unit (7) to the first heat radiating area (23), the second cooling means is arranged to transfer heat from the fuel cell (3) to the second heat radiating area (25), and the third cooling means is arranged to transfer heat from the drive motor (5) to the third heat radiating area (27).

8. A heat exchanger (1) according to Claim 7, wherein, in use, the first cooling body flows from the air conditioning unit (7) to the first heat radiating area via a first cooling body inlet passageway (19), and from the first heat radiating area to the air conditioning unit (7) via a first cooling body outlet passageway (21), and wherein the first heat exchanger (9) further comprises a first cooling body inlet (15) for receiving the first cooling body from the first cooling body inlet passageway (19), and a first cooling body outlet (17) for permitting the flow of the first cooling body out of the first heat exchanger (9) and into the first outlet passageway (21).

9. A heat exchanger (1) according to Claim 8, wherein, in use, the second cooling body flows from the fuel cell (3) to the second heat radiating area via a second cooling body inlet passageway (33), and from the second heat radiating area to the fuel cell (3) via a second cooling body outlet passageway (35), and wherein the second heat exchanger (11) further comprises a second cooling body inlet (29) for receiving the second cooling body from the second cooling body inlet passageway (33), and a second cooling body outlet (31) for permitting the flow of the second cooling body out of the second heat exchanger (11) and into the second cooling body outlet passageway (35).

10. A heat exchanger (1) according to Claim 9, wherein the third cooling body is transferred from the drive motor (5) to the third heat radiating area via a third cooling body inlet passageway (41), and from the third heat radiating area to the drive motor (5) via a third cooling body outlet passageway (43), and wherein the second heat exchanger (11) further comprises a third cooling body inlet (37) for receiving the third cooling body from the third cooling body inlet passageway (41), and a third cooling body outlet (39) for permitting the flow of the third cooling body out of the second heat exchanger (11) and into the third cooling body outlet passageway (43).

11. A heat exchanger (1) according to Claim 10, wherein in use, the relative temperatures of the cooling bodies at the first, second and third cooling body inlets (15,29,37) are given by the relationship: $Temperature_{first\ cooling\ body\ inlet} > Temperature_{second\ cooling\ body\ inlet} > Temperature_{third\ cooling\ body\ inlet}$, and wherein the relative temperatures of the cooling bodies at the first, second and third cooling body outlets (17,31,39) are given by the relationship: $Temperature_{second\ cooling\ body\ outlet} > Temperature_{third\ cooling\ body\ outlet} > Temperature_{first\ cooling\ body\ outlet}$.

12. A heat exchanger (1) according to any of Claims 7 to 11, wherein the second cooling body in the second heat radiating area (25) flows in a straight line from an upper area of the vehicle to a lower area of the vehicle.

13. A heat exchanger (1) according to any of Claims 7 to 12, wherein the third cooling body in the third heat radiating area (27) flows in a straight line from an upper area of the vehicle to a lower area of the vehicle.

ABSTRACT

HEAT EXCHANGER

A heat exchanger (1) for cooling three cooling bodies is described. The heat exchanger (1) comprises a first heat exchanger (9) having a first heat radiating area (23) arranged to

receive a flow of a first cooling body and to radiate heat therefrom, a second heat exchanger (11) comprising a second heat radiating area (25) arranged to receive a flow of a second cooling body and to radiate heat therefrom and a third heat radiating area (27) arranged to receive a flow of a third cooling body and to radiate heat therefrom. The second and third cooling bodies are disposed parallel to the respective second and third heat radiating areas (25,27), and the second and third heat radiating areas (25,27) are disposed rearward of the first heat radiating area (23). In use, the difference in temperature between the first cooling body entering the first heat radiating area (23) and exiting the first heat radiating area (23) is greater than the difference in temperature between the second cooling body entering the second heat radiating area (25) and exiting the second heat radiating area (25) and greater than the difference in temperature between the third cooling body entering the third heat radiating area (27) and exiting the third heat radiating area (27), and the temperature of the second cooling body flowing through the second heat radiating area (25) is higher than the temperature of the third cooling body flowing through the third heat radiating area (26). The second heat radiating area (25) is disposed on the upstream side of the flow direction of the first cooling body in the first heat radiating area (23), and the third heat radiating area (27) is located on the downstream side of the flow direction of the first cooling body in the first heat radiating area (27).

(Figure 1)